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FINAL INDEPENDENT EVALUATION PLAN FOR XM1 TURRET ORGANIZATIONAL--ETC(U)
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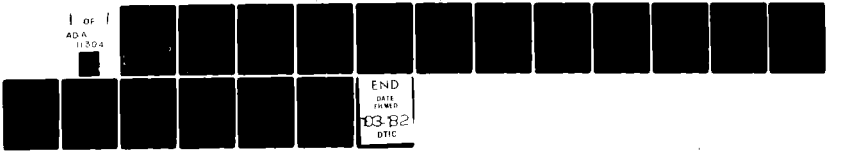

TRADOC ACN 39377

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FINAL

INDEPENDENT EVALUATION PLAN

FOR

XM1 TURRET ORGANIZATIONAL MAINTENANCE TRAINER

(TOMT)

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PREFACE

The purpose of this Independent Evaluation Plan (IEP) is to present issues and associated criterion to arrive at a decision to continue into the production stage of the XM1 Turret Organizational Maintenance Trainer (TOMT). This evaluation will be used to compile an Independent Evaluation Report (IER) and complement the completion of the Cost and Training Effectiveness Analysis (CTEA). The evaluation will ascertain the effectiveness of the XM1 TOMT within the XM1 turret mechanic (MOS 45E) program of instruction.

The major objectives of this IEP are as follows:

A. To determine the effectiveness of the XM1 TOMT.

B. To determine the logistical supportability of the XM1 TOMT.

C. To determine the adequacy of the XM1 TOMT human factors design with respect to operability and acceptability.

This IEP is organized into six sections: Failure Definition and Scoring Criterion (FD/SC); Issues and Associated Criterion; Concept of Evaluation; Data Source Matrix; and Milestones. Its content and format are consistent with the requirements of TRADOC Regulation 71-9, Appendix E.

CONTENTS

1.0 SYSTEM DESCRIPTION

1.1 NAME OF SYSTEM: XM1 Tank Turret Organizational Maintenance Trainer (TOMT).

1.2 BACKGROUND: An advanced fire control system for the XM1 has been designed to increase the tank fighting force capability. In order to fully realize this gain, the organizational turret mechanic must be thoroughly trained in maintaining the XM1 turret. The current method of using actual vehicles and components requires that the components be modified so that troubleshooting a fault isolation can be accomplished. This system requires complete tanks and components to be made nonoperational which limits flexibility in training and is also costly. These deficiencies, when coupled with increased student loads and course self-pacing, required the development of a cost and training effective turret maintenance trainer.

1.3 CHARACTERISTICS AND CONFIGURATION: The XM1 TOMT is a two part trainer consisting of a programmable maintenance trainer and an XM1 turret mock-up. The programmable maintenance trainer will be a troubleshooting device with a dynamic simulation display panel providing a block diagram delineation of the XM1 tank turret system. It will consist of a display panel with built-in STE-XM1 test set, master control panel, visual projection system, and an input/output communication device. The XM1 mock-up turret is a lightweight, realistic simulated turret which is configured to the actual interior of the XM1 tank turret. It will allow a trainee turret mechanic to perform realistic inspection, installation, purging, component removel and replacement, and other organizational maintenance procedures associated with the XM1 turret.

1.4 CONCEPT OF EMPLOYMENT: The XM1 TOMT will only be used in institutional maintenance courses for the organizational turret mechanic. The course will be self-paced, a system that requires instructors to allow a student to proceed at his own optimum learning pace. The device will enable an instructor to induce realistic malfunctions, demonstrate the systems operation and interdependence, as well as teach a large group of students proper maintenance procedures. When a malfunction is inserted the student will use the technical manual troubleshooting guide and follow the fault isolation procedures, using the panel test points and the STE-XM1. When the malfunctioning component is identified, the instructor can have the student go to the turret mock-up to complete the remove/replace function, or elect that the student push the remove/replace button on the panel to complete his troubleshooting procedures.

1.5 TEST MANAGER: H.L. Wardell, GS-11, Training Devices Div, DTD, USAARMC.

2.0 OPERATIONAL ISSUES

2.1 MISSION PERFORMANCE

2.1.1 ISSUE

Are the spatial arrangements of turret components consistent with those of the XM-1 turret in size, appearance, and present equal difficulty and constraints when performing required maintenance tasks?

1. Commander Control Panel Assembly.
2. Loaders Control Panel.
3. Turret Networks Box.
4. Commanders Weapons Station.
5. Turret Electrical Rack.
6. Turret Harness.
7. Turret Vent Blower Assembly.
8. Main Gun Electrical Assembly.
9. Ammo Door Electrical Assembly.
10. Fire Control Electrical Circuits.
11. Auxiliary Hydraulic Power Electrical Circuits.
12. Azimuth Gear Box Assembly.
13. Traverse Gear Box Assembly.
14. Elevation Mechanism Servo.
15. Turret Elevation Cylinder.
16. Control Assemblies (Gunners).
17. Main Accumulator.
18. Ammo Door Hydraulics.
19. DOS Electronics Unit.
20. Electronics Box.
21. Gun Turret Drive Electronics Unit.
22. Gyro Assemblies.
23. Hand Pump Assemblies.
24. Manual Elevation Pump Assembly.
25. Turret Hydraulic Valves, Lines Fittings and Gauges.
26. Laser Range Finder.
27. Thermal Imaging System.
28. Computer System.
29. Computer Sensor Assemblies.
30. GPS Assembly.
31. Computer Sensor Assemblies.
32. GPS Control Panels.
33. Commanders GPS Assembly.
34. Gunner's Auxiliary Sight.
35. Commanders Weapons Sight Assembly.
36. Muzzle Reference System.
37. Crosswind Sensor.
38. Seats - Gunners, Tank Commander, Loader.
39. Loaders Knee Switch.
40. Commanders Weapon Station Tape Drive.
41. Slip Ring.
42. CBR Heater and Filter.
43. GPS Housing W/Linkage.
44. Main Gun Elev Interference Switch.

2.1.1 ISSUE (Cont'd)

45. Spent Ammo Box.
46. Ejection Chute.
47. Weapon Mount.
48. Ammo Feed Chute.
49. Ammo Ready Box Assembly.
50. Ammo Rack Assembly.
51. 50 Cal. Storage Box.
52. Gunners Left Knee Guard.
53. Commanders Guard Assembly.
54. Motor Brake Assembly.
55. Traverse Mech Assembly.
56. CBR Hose.
57. Loader Shoulder Guard.
58. Power Control Unit.
59. Fire Sensor.
60. GPS Purging Valve.
61. Ballistic Shield and Mechanism.
62. Replenisher.
63. Coaxial MG Mount.
64. MRS Call Assembly.
65. CWS Support Rollers.
66. CWS Motor Brake.
67. CWS Gear Box.
68. Gunners Aux Control Panel.
69. Radios, Junction Boxes and Channel Selectors W/Wiring.
70. Thermal Receiver Unit.

2.1.1.1 SCOPE

The evaluation will draw data from DT and OT operations. Size and location of components is basically an engineering, DT objective. The constraints and resemblance of the components in relation to required maintenance functions will be evaluated during OT while students conduct classes on the trainer.

2.1.1.2 CRITERIA

a. Components must be located in the same position and tasks performed in the same manner as in the actual XM1 Turret.

b. The same space constraints found around the components in the Turret must be found in the Trainer.

2.1.1.3 RATIONALE

In order to maximize training benefit, the student must perform his tasks in the same manner and under the same constraints as on the actual tank.

2.1.1.4 SOURCE

XM-1 TOMT TDR 3 Feb 78.

2.2 TRAINING

2.2.1 ISSUE

Is the output provided the instructor by the device's built in evaluation capability sufficient for the instructor to evaluate and critique the student?

2.2.1.1 SCOPE

The device output data will be examined through subjective evaluation. Evaluation will be based on interviews from instructors, trainees and personnel in the maintenance field not connected with the test.

2.2.1.2 CRITERIA

a. The devices built in evaluation capability should give the instructor sufficient information in clarity and text to determine if the student has met the training objectives.

b. The format should be easily read by the student.

2.2.2.3 RATIONALE

In order for the print out to be of value to the instructor as well as the student, it must be easily read and have clarity of understanding.

2.2.2.4 SOURCE: DTD, Dec 79

2.2.2 ISSUE

what is the potential training value of the TOMT in teaching MOS 45E turret mechanics organizational maintenance level troubleshooting, repair and replacement when used in the context of the program or instruction?

2.2.2.1 SCOPE

The evaluation will determine to what extent the TOMT has training potential as a training device during instruction of required tasks as outlined in the program of instruction for the 45E organizational turret mechanic. Students will be tracked throughout their course to ascertain the successful completion of required tasks.

2.2.2.2 CRITERIA

a. Given the technical manual for organizational maintenance, the troubleshooting panel board, and the turret mock-up, the student will be able to satisfactorily perform the procedures stated in the manual, identify malfunctioning components/sytems and take corrective action necessary to correct the malfunction in the time standard stipulated in the appropriate lesson plan.

b. Satisfactory performance of a procedural task will be defined in the appropriate lesson plan for that task. Performance will be graded as satisfactory when the student performs a given task and satisfies all the standards for that task.

2.2.2.3 RATIONALE

To have training potential, the device must enable the student to satisfactorily perform designated tasks to specified standards.

2.2.3.4 SOURCE: XM1 TOMT TDR

2.2.3 ISSUE

What are the training resource requirements used to conduct the XM1 TOMT program of instruction?

2.2.3.1 SCOPE

This issue includes an examination of the operating and support requirements used to conduct the XM1 TOMT program of instruction. Minimum required data includes:

a. Personnel resources used to plan, prepare, conduct, and evaluate the maintenance training:

   (1) Primary personnel.

   (2) Support personnel.

   (3) Rank/grade.

   (4) Function(s).

   (5) Time expended per function.

b. Time utilized by each student to meet the program of instruction training objectives.

c. Additional militay support equipment utilized in support of the maintenance training.

2.2.3.2 CRITERIA.

None.

2.2.3.3 RATIONALE.

To determine the efficiency of the XM1 TOMT training program, the training resource requirements must be examined in detail.

2.2.3.4 SOURCE. XM1 TOMT TDR.

2.2.4 ISSUE.

Is the XM1 TOMT considered safe in an operational environment?

2.2.4.1 SCOPE.

The safety of the TOMT will be evaluated during the test to ensure safe operation.

2.2.4.2 CRITERION.

The device will be free of mechanical, electrical, and chemical hazards and contaminents. It must present safe working conditions for all user personnel.

2.2.4.3 RATIONALE. Self-explanatory.

2.2.4.4 SOURCE. XM1 TOMT TDR.

2.2.5 ISSUE.

Can the instructor properly operate and conduct instruction using the TOMT?

2.2.5.1 SCOPE.

The evaluation will determine the adequacy of the contractor conducted instructor course to ensure that it properly prepares the instructor to prepare instruction, conduct classes, and evaluate student performance. An observation will be conducted of the instructor's ability to conduct training and critique student performance. In addition, questionnaires will be completed by students using the device to evaluate the training sessions and instructor performance.

2.2.5.2 CRITERION:

The instructor will be able to:

a. Properly select malfunctions and program appropriately.

b. Monitor the students' performance.

c. Answer student questions and provide assistance as required.

d. Critique performance using the hard copy print-out.

2.2.5.3 RATIONALE:

Self-explanatory.

2.2.5.4 SOURCE:

XM1 TOMT TDR.

2.3 LOGISTICS

2.3.1 ISSUE:

Is the logistical support concept for the operator/instructor adequate?

2.3.1.1 SCOPE: The evaluator will consider:

a. The abilities of the instructor to perform preoperational checks and maintenance required.

b. The adequacy of the instructor's manual.

c. The allocation of maintenance responsibilities consistent with the MAC Chart.

d. The adequacy of the instructor/operator PLL.

2.3.1.2 CRITERIA:

a. The instructor, given the instructor/operator manual will be able to complete the preoperational checks utilizing the built-in test GO/NO GO function of the device, within 30 minutes.

b. The instruction manual must be written and organized in such a manner so to provide clear, concise, logical, and easily understandable instruction to the operator in the performance of his assigned duties.

c. The allocation of instructor maintenance will be within the instructor capabilities given that the instructor has received the contractor directed operator's course.

d. Once faulty components are identified by the instructor, those parts must be available in the PLL.

2.3.1.3 RATIONALE.

The logistics support concept for the operator/instructor, as designed by the contractor, must be assessed to determine its adequacy for institutional use. Results from the evaluation might determine design changes and modification for any follow-on production devices.

2.3.1.4 SOURCE. XM1 TOMT TDR, TRADOC Reg 71-9.

2.3.2 ISSUE.

Is the logistical support concept for in-house maintenance adequate?

2.3.2.1 SCOPE. The evaluation will determine.

a. The capabilities of the DIO repairmen to perform required maintenance on the devices.

b. The adequacy of the stockage level of repair parts at DIO level.

c. The allocation of maintenance responsibilities to maximize personnel capabilities.

2.3.2.2 CRITERIA.

a. The DIO repairmen will be capable of performing maintenance and repair, when required, such that the prescribed operational availability of 90 percent is attained.

b. Stockage of parts to support required maintenance actions will be adequate to support the device.

c. Maintenance responsibilities as directed by the MAC will maximize on-site maintenance. (During the evaluation it may be discovered that a particular maintenance function required to be performed by the DIO repairmen is within the capabilities of the instructor.)

2.3.2.3 RATIONALE.

The logistics support concept for government maintenance needs to be assessed for responsiveness, timeliness, and completeness, in order to determine if the maintenance concept is adequate.

2.3.2.4 SOURCE. XM1 TOMT TDR, TRADOC Reg 71-9.

2.3.3 ISSUE.

Does the XM1 TOMT demonstrate sufficient RAM while performing mission tasks in an operational environment?

2.3.3.1 SCOPE.

Operational RAM characteristics of the trainer will be evaluated during normal training operations. The following minimum information is needed:

a. Total operational hours.

b. Failure description.

c. Time to repair.

d. Frequency of failure by type.

2.3.3.2 CRITERIA.

2.3.3.2.1 OPERATIONAL RELIABILITY.

a. The TOMT must have a minimum acceptable value (MAV) of 100 hours mean time between failures (MTBF).

b. The TOMT should have a best operational capability (BOC) of 375 hours MTBF.

2.3.3.2.2 OPERATIONAL AVAILABILITY.

The operational availability for the TOMT should be 90 percent based upon an 80-hour week. During the test, the trainer will be operated only 40 hours per week based on peacetime training schedule and contractor support. The 80-hour availability will be calculated using data gathered from the 40-hour week.

2.3.3.3 RATIONALE

RAM testing is required by AR 702-3 and has a critical function in making a production decision n the device.

2.3.3.4 SOURCE; XM1 TOMT TDR, AR 702-3, TRADOC REG 71-9

3.0 CONCEPT OF EVALUATION

A skills and knowledge test will be administered prior to participation in the training program to determine entry level proficiency. Selected students will participate in a training program structured to teach initial entry 45E mechanics required maintenance procedures. Students will be evaluated on the training effectiveness gained attributed to the training device. Upon completion of the end of course test on the device, students will be required to demonstrate their proficiency on the XM-1 tank performing selected maintenance tasks.

Instructors will participate in a contractor sponsored training course. The purpose of the course will be basically two-fold: 1) To train the instructor to properly use the device in his instructional role, and 2) To train the instructor and perform required maintenance actions including preoperational checks, routine services, and unscheduled operator maintenance.

Logistical and RAM data will be gathered throughout the conduct of the evaluation, commencing with the Developmental Test and continuing through the completion of the Operational Test.

4.0 DATA SOURCE MATRIX

	DATA SOURCE	
ISSUE	DT	OT
2.1.1	P	S
2.2.1		P
*2.2.2		P
2.2.3		P
*2.2.4	S	P
2.2.5		P
*2.3.1		P
*2.3.2	S	P
*2.3.3	S	P

*Critical Issues.

5.0 MAJOR MILESTONES

IEP	1 Aug 80
Proponent Concurrence with OTP	5 Aug 80
SSP	Jan 81
NET TSP	Not Required
Doctrinal and Organizational TSP	30 Sep 80
Training TSP	? Feb 81
Threat TSP	Not Required
TDP	15 Feb 81
Receipt of Test Item	9 Feb 81
OTRS	15 Feb 81
Safety Release	1 Feb 81
Test Start	15 Mar 81
Test Complete	30 May 81
Test Report	30 Jul 81
IER	29 Aug 81
IPR	Sep 81

APPENDIX A

FAILURE DEFINITION

Related to trainer reliability, the definition of failure is provided. A failure is defined as any malfunction which the operator/instructor cannot remedy by adjustment, repair, or replacement using the controls, tools and parts authorized within 15 minutes which causes or may cause:

a. Inability to commence operation, cessation of operation, or degradation of performance capability of the trainer/subsystem below designated specification or performance levels.

b. Serious damage to the trainer system, subsystem, if operations were continued.

c. Personnel safety hazards.

d. A requirement for corrective maintenance action requiring maintenance support beyond the operator/instructor maintenance category. (The 15 minute remedy time is not applicable to these failures.)

MALFUNCTION GUIDELINES. Related to failures, the following malfunction guidelines are provided.

a. Simultaneous related malfunctions are considered as one failure.

b. Simultaneous unrelated malfunctions are considered as two or more failures,

c. A malfunction discovered during preventive (scheduled) maintenance that requires corrective maintenance at categories above organizational maintenance will be counted as mission failure.

d. Software malfunctions will also be charged as failures as applicable. To be chargeable as a software induced failure, the non-operational status must be linked to or associted with a particular set of parameters which can be consistently (repetitively) reproduced. The first occurrence of the malfunction will be chargeable and subsequent (same) malfunctions will not be chargeable.

e. A malfunction that cannot be traced to a specific equipment or software failure and reoccurs more than twice within 24 operational hours will be considered a phantom failure and charge against system/ subsystem mission reliability.

f. The following are not considered mission failures:

1. Scheduled replacement of parts prior to failure.

2. Incipient malfunction corrected during scheduled preventive maintenance on the trainer when performed by the operator/instructor.

3. A malfunction resulting from test item abuse, operator error, unrealistic operating conditions, or accident.

4. A malfunction resulting from not adhering to the prescribed operational or maintenance procedures or the equipment manuals.

5. Actual or incipient malfunctions detected or corrected during initial technical inspections.

6. Malfunctions detected during test that do not affect the mission reliability and are deferred to final technical inspection (at termination of testing) will not be charged as mission failure.


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